

WHAT IS CLAIMED IS:

1. A East-West separable Reconfigurable Optical Add/Drop Multiplexer, optically coupled to a plurality of fibers in a plurality of fiber arrays, the East-West separable ROADM comprising:

a plurality of first cylindrical lenses positioned to collimate in a first axis an optical signal provided by a corresponding optical fiber in a first fiber array forming a first axis collimated optical signal;

a second cylindrical lens positioned to collimate in a second axis the first axis collimated optical signal to form a first multi-axis collimated optical signal;

a first wavelength separating medium angularly diffracting light incident to the wavelength separating medium into a plurality of angularly diffracted light signals, the wavelength separating medium positioned to have incident thereon the multi-axis collimated optical signal;

a third lens positioned to focus the plurality of angularly diffracted light signals;

a first plurality of transmissive beam directors in a beam director array optically between the first wavelength separating medium and a first plurality of beam reflectors in a beam reflector array;

the first plurality of beam reflectors in the beam reflector array comprised of at least one beam reflector positionable to reflect at least some of the angularly diffracted light;

an anamorphic relay lens positioned to focus the plurality of angularly diffracted light signals;

a second plurality of transmissive beam directors in a beam director array optically between the second wavelength separating medium and a second plurality of beam reflectors in a beam reflector array;

the plurality of second beam reflectors in the beam reflector array comprised of at least one beam reflector positionable to reflect at least some of the angularly diffracted light;

a fourth lens positioned to collimate the plurality of angularly diffracted light signals into a second multi-axis collimated optical signal;

a second wavelength separating medium angularly diffracting light incident to the wavelength separating medium, the wavelength separating medium positioned to have incident thereon the second multi-axis collimated optical signal;

a fifth cylindrical lens positioned to focus in the second axis the second multi-axis collimated optical signal;

a plurality of sixth cylindrical lenses positioned to focus in the first axis the second multi-axis collimated optical signal.

2. The East-West separable Reconfigurable Optical Add/Drop Multiplexer of claim 1, wherein the first wavelength separating medium is a transmissive grating, and wherein the second wavelength separating medium is a transmissive grating.

3. The East-West separable Reconfigurable Optical Add/Drop Multiplexer of claim 2, wherein the first transmissive wavelength separating medium is operating near Littrow, and wherein the second transmissive wavelength separating medium is operating near Littrow,

4. The East-West separable Reconfigurable Optical Add/Drop Multiplexer of claim 1, wherein the first wavelength separating medium is a reflective grating, and wherein the second wavelength separating medium is a reflective grating.

5. The East-West separable Reconfigurable Optical Add/Drop Multiplexer of claim 4, wherein the first reflective wavelength separating medium is operating near Littrow, and wherein the second reflective wavelength separating medium is operating near Littrow.

6. The East-West separable Reconfigurable Optical Add/Drop Multiplexer of claim 1, wherein the plurality of transmissive beam directors in the first beam director array are positionable in two axes, and wherein the plurality of transmissive beam directors in the second beam director array are positionable in two axes.

7. The multi-channel optical switching system of claim 1, wherein the plurality of transmissive beam directors in the first beam director array are liquid crystal beam steerers, and wherein the plurality of transmissive beam directors in the second beam director array are liquid crystal beam steerers.

8. A East-West separable Reconfigurable Optical Add/Drop Multiplexer, optically coupled to a plurality of fibers in a plurality of fiber arrays, the East-West separable RECONFIGURABLE OPTICAL ADD/DROP MULTIPLEXER comprising:

a plurality of first lenses positioned to collimate in a first axis and a second axis an optical signal provided by a corresponding optical fiber in a first fiber array forming a first multi-axis collimated optical signal;

a first wavelength separating medium angularly diffracting light incident to the wavelength separating medium into a plurality of angularly diffracted light signals, the wavelength separating medium positioned to have incident thereon the multi-axis collimated optical signal;

a third lens positioned to focus the plurality of angularly diffracted light signals;

a first plurality of transmissive beam directors in a beam director array optically between the first wavelength separating medium and a first plurality of beam reflectors in a beam reflector array;

the first plurality of beam reflectors in the beam reflector array comprised of at least one beam reflector positionable to reflect at least some of the angularly diffracted light;

a relay lens positioned to focus the plurality of angularly diffracted light signals;

a second plurality of transmissive beam directors in a beam director array optically between the second wavelength separating medium and a second plurality of beam reflectors in a beam reflector array;

the plurality of second beam reflectors in the beam reflector array comprised of at least one beam reflector positionable to reflect at least some of the angularly diffracted light;

a fourth lens positioned to collimate the plurality of angularly diffracted light signals into a second multi-axis collimated optical signal;

a second wavelength separating medium angularly diffracting light incident to the wavelength separating medium, the wavelength separating medium positioned to have incident thereon the second multi-axis collimated optical signal;

a plurality of sixth cylindrical lenses positioned to focus in the first and the second axis the second multi-axis collimated optical signal.

9. The East-West separable Reconfigurable Optical Add/Drop Multiplexer of claim 8, wherein the relay lens is an anamorphic lens.

10. The East-West separable Reconfigurable Optical Add/Drop Multiplexer of claim 8, wherein the first wavelength separating medium is a transmissive grating, and wherein the second wavelength separating medium is a transmissive grating.

11. The East-West separable Reconfigurable Optical Add/Drop Multiplexer of claim 10, wherein the first transmissive wavelength separating medium is operating

near Littrow, and wherein the second transmissive wavelength separating medium is operating near Littrow,

12. The East-West separable Reconfigurable Optical Add/Drop Multiplexer of claim 8, wherein the first wavelength separating medium is a reflective grating, and wherein the second wavelength separating medium is a reflective grating.

13. The East-West separable Reconfigurable Optical Add/Drop Multiplexer of claim 12, wherein the first reflective wavelength separating medium is operating near Littrow, and wherein the second reflective wavelength separating medium is operating near Littrow.

14. The East-West separable Reconfigurable Optical Add/Drop Multiplexer of claim 8, wherein the plurality of transmissive beam directors in the first beam director array are positionable in two axes, and wherein the plurality of transmissive beam directors in the second beam director array are positionable in two axes.

15. The multi-channel optical switching system of claim 8, wherein the plurality of transmissive beam directors in the first beam director array are liquid crystal beam steerers, and wherein the plurality of transmissive beam directors in the second beam director array are liquid crystal beam steerers.

16. A East-West separable Reconfigurable Optical Add/Drop Multiplexer, optically coupled to a plurality of fibers in a plurality of fiber arrays, the East-West separable ROADM comprising:

a plurality of first lenses positioned to collimate in a first axis and a second axis an optical signal provided by a corresponding optical fiber in a first fiber array forming a first multi-axis collimated optical signal;

a first wavelength separating medium angularly diffracting light incident to the wavelength separating medium into a plurality of angularly diffracted light signals, the wavelength separating medium positioned to have incident thereon the multi-axis collimated optical signal;

a third lens positioned to focus the plurality of angularly diffracted light signals;

a first plurality of transmissive beam directors in a beam director array optically between the first wavelength separating medium and a first plurality of beam reflectors in a beam reflector array;

the first plurality of beam reflectors in the beam reflector array comprised of at least one beam reflector positionable to reflect at least some of the angularly diffracted light;

a second plurality of transmissive beam directors in a beam director array optically between the second wavelength separating medium and a second plurality of beam reflectors in a beam reflector array;

the plurality of second beam reflectors in the beam reflector array comprised of at least one beam reflector positionable to reflect at least some of the angularly diffracted light;

a fourth lens positioned to collimate the plurality of angularly diffracted light signals into a second multi-axis collimated optical signal;

a second wavelength separating medium angularly diffracting light incident to the wavelength separating medium, the wavelength separating medium positioned to have incident thereon the second multi-axis collimated optical signal;

a plurality of sixth cylindrical lenses positioned to focus in the first and the second axis the second multi-axis collimated optical signal.

17. The East-West separable Reconfigurable Optical Add/Drop Multiplexer of claim 16, wherein the first wavelength separating medium is a transmissive grating, and wherein the second wavelength separating medium is a transmissive grating.

18. The East-West separable Reconfigurable Optical Add/Drop Multiplexer of claim 17, wherein the first transmissive wavelength separating medium is operating near Littrow, and wherein the second transmissive wavelength separating medium is operating near Littrow,

19. The East-West separable Reconfigurable Optical Add/Drop Multiplexer of claim 16, wherein the first wavelength separating medium is a reflective grating, and wherein the second wavelength separating medium is a reflective grating.

20. The East-West separable Reconfigurable Optical Add/Drop Multiplexer of claim 19, wherein the first reflective wavelength separating medium is operating near Littrow, and wherein the second reflective wavelength separating medium is operating near Littrow.



21. The East-West separable Reconfigurable Optical Add/Drop Multiplexer of claim 16, wherein the plurality of transmissive beam directors in the first beam director array are positionable in two axes, and wherein the plurality of transmissive beam directors in the second beam director array are positionable in two axes.

22. The multi-channel optical switching system of claim 16, wherein the plurality of transmissive beam directors in the first beam director array are liquid crystal beam steerers, and wherein the plurality of transmissive beam directors in the second beam director array are liquid crystal beam steerers.

23. A method performed by a East-West separable Reconfigurable Optical Add/Drop Multiplexer optically coupled to a plurality of fibers in a first fiber array providing an optical signal, and optically coupled to a plurality of second fibers receiving an optical signal, the method comprising:

collimating a received optical signal in a first axis to form a first single-axis collimated optical signal using at least one of a plurality of first cylindrical lenses;

collimating the first single axis collimated optical signal in a dual axis to form a first multi-axis collimated optical signal using a second cylindrical lens;

angularly diffracting the dual-axis collimated optical signal to form angularly diffracted light using a first wavelength separating medium;

focusing at least some of the angularly diffracted light through at least one of a first plurality of transmissive beam directors in a beam director array and near a first plurality of beam reflectors in a beam reflector array using a third lens;

focusing at least some of the angularly diffracted light through at least one of a second plurality of transmissive beam directors in a beam director array and near a second plurality of beam reflectors in a beam reflector array using an anamorphic relay lens;

directing at least some of the angularly diffracted light using at least one of the first plurality of beam directors and at least one of the second plurality of beam directors;

collimating at least some of the directed angularly diffracted light into a second multi-axis collimated optical signal using a fourth lens;

angularly diffracting the second multi-axis collimated optical signal on a selected optical path to at least one of the plurality of second fibers using a second wavelength separating medium;

focusing the angularly diffracted second multi-axis collimated optical signal in the second axis using a third cylindrical lens;

focusing the angularly diffracted second multi-axis collimated optical signal in the first axis to at least one of a plurality of fourth cylindrical lenses.

24. A method performed by a East-West separable Reconfigurable Optical Add/Drop Multiplexer optically coupled to a plurality of fibers in a first fiber array providing an optical signal, and optically coupled to a plurality of second fibers receiving an optical signal, the method comprising:

collimating a received optical signal in a first axis and a second to form a first multi-axis collimated optical signal using a first lens;

angularly diffracting the dual-axis collimated optical signal to form angularly diffracted light using a first wavelength separating medium;

focusing at least some of the angularly diffracted light through at least one of a first plurality of transmissive beam directors in a beam director array and near a first plurality of beam reflectors in a beam reflector array using a second lens;

focusing at least some of the angularly diffracted light through at least one of a second plurality of transmissive beam directors in a beam director array and near a second plurality of beam reflectors in a beam reflector array using a relay lens;

directing at least some of the angularly diffracted light using at least one of the first plurality of beam directors and at least one of the second plurality of beam directors;

collimating at least some of the directed angularly diffracted light into a second multi-axis collimated optical signal using a third lens;

angularly diffracting the second multi-axis collimated optical signal on a selected optical path to at least one of the plurality of second fibers using a second wavelength separating medium;

focusing the angularly diffracted second multi-axis collimated optical signal in the first axis and second axis using a fourth lens.

25. A method performed by a East-West separable Reconfigurable Optical Add/Drop Multiplexer optically coupled to a plurality of fibers in a first fiber array providing an optical signal, and optically coupled to a plurality of second fibers receiving an optical signal, the method comprising:

collimating a received optical signal in a first axis and a second to form a first multi-axis collimated optical signal using a first lens;

angularly diffracting the dual-axis collimated optical signal to form angularly diffracted light using a first wavelength separating medium;

focusing at least some of the angularly diffracted light through at least one of a first plurality of transmissive beam directors in a beam director array, near a first plurality of beam reflectors in a beam reflector array using a second lens, through at least one of a second plurality of transmissive beam directors in a beam director array, and near a second plurality of beam reflectors in a beam reflector array using a second lens;

directing at least some of the angularly diffracted light using at least one of the first plurality of beam directors and at least one of the second plurality of beam directors;

collimating at least some of the directed angularly diffracted light into a second multi-axis collimated optical signal using a third lens;

angularly diffracting the second multi-axis collimated optical signal on a selected optical path to at least one of the plurality of second fibers using a second wavelength separating medium;

focusing the angularly diffracted second multi-axis collimated optical signal in the first axis and second axis using a fourth lens.